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Photographs of Comet c 1908, taken at the Royal Observatory, Greenwich.

(*Communicated by the Astronomer Royal.*)

This comet has been under observation at the Royal Observatory since the announcement of its discovery by Morehouse at the Yerkes Observatory.

Photographs with short exposure, for determination of its position, have been taken with the 30-inch reflector on every available night, but in addition an extensive series of photographs with long exposures, varying from 5 to 60 minutes, have been secured on every possible occasion. The first photograph, taken on September 4, showed that the comet had a considerable tail. Subsequent photographs on September 6, 7, and 8 showed such remarkable changes in the formation of the tail that it was obvious that it would be necessary to photograph at much shorter intervals than 24 hours in order to follow these changes. It was decided, therefore, that photographs should be taken at short intervals through the night. At first exposures up to about 60 minutes were given, sufficient to show the tail extending to the edge of the plate, a distance of about 90′, but later, as the comet became brighter, the exposure was shortened to 10–15 minutes so that the fine detail should not be blurred by the motion of the particles in the tail.

Supplementing the above series, a number of photographs have been obtained with a portrait lens of 3¼ inches aperture and 11 inches focal length (kindly lent by Mr. W. Bowyer), with exposures ranging from 24 minutes to 90 minutes.

List of Photographs of Comet c 1908, taken with the 30-inch Reflector.

Date. 1908.		Limiting Times of Photographs (Middle of Exposure), G.M.T.	No. of Photos.	Exposure.	Remarks.
		h m h m		m m	
Sept.	4	15 44	1	10	Guiding imperfect, the motion of the comet being unknown. Tail extends 30′.
	6	14 14–15 31	2	30, 47	Principal feature — parabolic envelopes, which are unsymmetrically arranged about nucleus.
	7	14 56–15 48	2	60, 15	Coma bright; envelopes no longer pronounced; tail consists of wavy streamers much disturbed. Dark rays shown. These appear to be darker than the background of the sky.
	8	15 37	1	45	Head similar to Sept. 7; tail consists of two main streamers much contorted.

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Photographs taken with the 30-*inch reflector*—continued.

Date. 1908.	Limiting Times of Photographs (Middle of Exposure), G.M.T.	No. of Photos.	Exposure.	Remarks.
	h m h m		m m	
Sept. 14	7 55– 8 22	2	20, 20	Coma condensed. Tail consists of two main rays enclosing an angle of about 9°. A detached V-shaped portion about 20′ from head has moved 1′ in the interval (hourly motion about 2′ away from the head).
17	8 12–10 4	3	45	Bright condensed coma. Tail consists of straight rays. A bright parabolic envelope on the first photograph is shown as straight rays on the last. Tail fan-shaped, with about eight rays.
18	10 0–11 2	2	45	Coma becoming more diffused. Envelopes appear to be forming about nucleus ; three shown on second photograph.
21	14 41	1	55	Tail fan-shaped ; somewhat similar to Sept. 18.
25	9 21	1	18	Stellar nucleus with several parabolic envelopes. Tail fan-shaped.
26	8 10	1	60	Tail fan-shaped ; considerably disturbed.
29	7 39–16 15	9	15 to 50	Stellar nucleus, bright coma with envelopes forming towards end of night. Five shown on last plate. They form at about 2′ from the nucleus (on the side towards the sun). Very bright tail, consisting of wavy streamers considerably disturbed. A pronounced dark ray shown. From measures of features in the tail the following motions have been deduced:— Distance from nucleus, 6′. Motion outwards, 0′·24 per hour. Distance from nucleus, 12′. Motion outwards, 0′·64 per hour. Distance from nucleus, 19′. Motion outwards, 0′·94 per hour.
30	8 8–14 27	6	15 to 61	Very bright tail, more violently disturbed than on Sept. 29. Several pronounced dark rays. From measures of features in the tail :— Distance from nucleus, 5′. Motion outwards, 1′·5 per hour. Distance from nucleus, 6′. Motion outwards, 1′·5 per hour. Distance from nucleus, 8′. Motion outwards, 1′·3 per hour.

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Photographs taken with the 30-inch reflector—continued.

Date 1908.		Limiting Times of Photographs (Middle of Exposure), G.M.T.	No. of Photos.	Exposure.	Remarks.
		h m h m		m m	
Oct.	1	7 53–14 35	8	15 to 40	Tail now consists of straight streamers. The outburst has subsided, and the disturbance of Sept. 30 is now seen as a detached mass about a degree away. The motion outward of this mass at a distance of 75′ is 6′·6 per hour.
	2	7 46–10 21	4	20 to 40	Large coma, many envelopes forming. Tail becoming fan-shaped, with several straight streamers.
	3	7 16–13 13	9	15 to 40	Nucleus stellar, with parabolic envelopes. Tail fan-shaped, composed mainly of four strong rays. The fan covers an angle of 60° at commencement of night, but closes into one of 30° at end. Much fine detail.
	5	13 15–16 41	6	5 to 40	Streaming tail, with much fine detail. At distance 4′, motion 0′·8 per hour. At distance 8′, motion 1′·1 per hour. At distance 21′, motion 2′·2 per hour.
	6	7 36– 8 36	2	15, 30	Straight rays from the head; the activity of Oct. 5 has apparently ceased.
	14	8 30–10 14	4	10	Stellar nucleus. Streaming tail, with much fine detail.
	15	7 3–10 25	5	10	Coma brighter. The activity of Oct. 14 has subsided, leaving two principal straight streamers. The tail of Oct. 14 is now seen as a detached mass about 30′ away. At distance 25′, motion 2′·6 per hour.
	18	7 58– 9 50	3	10	Coma bright. Envelopes developing. Tail greatly disturbed, with much fine detail near head. At distance 4′, motion 0′·5 per hour. At distance 21′, motion 1′·4 per hour.
	19	11 56	1	10	Poor sky, little shown.

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Photographs taken with the 30-*inch reflector*—continued.

Date 1908.	Limiting Times of Photographs (Middle of Exposure), G.M.T.	No. of Photos.	Exposure.	Remarks.
	h m h m		m m	
Oct. 21	6 26–12 13	8	10 to 15	Stellar nucleus, with many envelopes. Streaming tail much disturbed. At distance 3′, motion 0′·3 per hour. At distance 21′, motion 1′·4 per hour. At distance 34′, motion 2′·4 per hour.
23	7 8–10 47	7	5 to 15	Bright stellar nucleus; many envelopes, developing into finely pencilled straight streamers.
24	6 54	1	6	Stellar nucleus. Streaming tail.
26	9 44	1	10	Very poor sky, little shown.
27	6 41–10 28	10	10 to 20	Many envelopes forming. Tail much disturbed; apparently composed of straight and wavy streamers intermingled. An envelope was observed to form with its apex distant 2′·0 from the nucleus; in 2¼ hours, it had closed in to a distance of 1′·1 from the nucleus.
29	6 38– 8 46	3	20	Stellar nucleus, coma faint. Tail emerges in straight rays, covering an angle of 13°.
30	6 21– 9 19	9	10 to 21	Coma brighter, with many envelopes. Tail composed of wavy streamers much disturbed. A disruption appears about 16′ from head. At distance 16′, motion 2′·2 per hour.
Nov. 3	6 0– 7 54	6	10	Bright coma. Tail composed of wavy streamers, with some disturbance.
8	5 59– 7 24	5	5 to 10	Diffused nucleus. Tail composed of straight rays, with some disturbance.
9	6 5– 6 22	2	10	Wavy, well-defined streamers, curiously bent near the head.
10	5 44– 6 30	4	10	Many envelopes. Tail composed of wavy streamers somewhat disturbed. Some dark rays. At distance 75′ motion 2′·4 per hour.
12	6 38	1	14	Stellar nucleus, many envelopes.

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List of Photographs of Comet c 1908, taken with the Portrait Lens.

Date 1908.		Limiting Times of Photographs (Middle of Exposure), G.M.T.	No. of Photos.	Exposure.	Remarks.
		h m h m		m m	
Sept.	20	11 24	1	24½	Tail can be traced 2°. Sharp bend about 10′ from head.
	21	13 10	1	40	Tail can be traced 3° to 4°. Broken about 40′ from head.
	29	8 12	1	80½	Tail can be traced about 8°.
	30	8 38	1	81	Tail can be traced about 6°. Contracts about 1½° from head.
Oct.	1	8 55	1	80	Remarkable photograph. Up to 1° from nucleus, tail consists of fine straight rays. From that point outwards is a bright detached mass, apparently the matter forming the tail of Sept. 30. At 4° from the head the tail becomes much spread out and diffused.
	2	9 0	1	75	Tail can be traced 8°. Near the head it consists of fine radiating streamers. At 3° from head commences the diffused mass shown detached on Oct 1. Deduced motion about 5′ per hour.
	3	8 50–12 51	2	60, 53	Brightest streamer can be traced 4°.
	15	7 4–10 6	2	29½, 33	Tail spreads at a distance of 5°, and can be traced to 7°. Curious break at ½° from head.
	18	9 53	1	32	Straight diffused tail 5° long. From 2° to 4° it is faint and broken. At 4° there is a brighter portion.
	21	7 22	1	90	Straight tail, which can be traced 7°.
	23	9 41	1	40	Tail can be traced 6°.
	27	7 31	1	90	Tail can be traced 9°. Very bright at 3½° from nucleus.
	28	7 23	1	46	Activity of Oct. 27 has died away. Tail can be traced 7°. Near the head it is composed of fine rays. Broadens suddenly at ½° from head.
	29	7 3	1	65	Tail can be traced 8°.
	30	6 56	1	40	Very bright tail, which can be traced 11°.
Nov.	3	7 7	1	30	Moonlight. Tail can be traced 5°.
	10	5 57	1	30	Tail can be traced 7°.

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A study of the photographs shows that the form of the comet's tail exhibits a recurring series of phases, and that the phase seems to bear a relation to the condition of the nucleus which passes through cycles of stages of alternating activity and quiescence.

At the stage of quiescence the comet presents the appearance of a nucleus with little enveloping coma, and straight streamers passing away at little inclination to the general direction of the tail. The coma then grows, envelopes form about the nucleus (on the side towards the Sun), and the rays of the tail become more spread. The stage of maximum activity is now reached, and larger quantities of matter appear to be expelled from the head and then driven back, forming a bright wavy tail, the streamers being no longer straight, but greatly disturbed. This bright tail then appears to be driven off and the stage of quiescence follows.

Much measurable detail is shown on the photographs, and the few tentative measures which have been made (see "Remarks") indicate that the matter forming the tail is moving from the head at an accelerating velocity. At present it is not possible to say more, but when the material has been fully discussed the results will be communicated to the Society.

Royal Observatory, Greenwich:
1908 *November* 9.

On the Photographs of Comet c 1908 (*Morehouse*).

By E. E. Barnard. (Plates 2, 3.)

This comet has shown very remarkable phenomena. In some respects they were quite different from those of any comet which has appeared since these bodies have been under photographic study. Even in its quieter phases it has been apparently as active as the larger naked-eye comets. There have, however, been several outbursts that were very extraordinary, and in some respects quite unique. The photographs show that these disturbances occurred on or about September 16, 30, October 1, 6, and 15. I have selected from these photographs the following list of lantern slides which accompany this note. I have separated them into three sets: in the first set the photographs were made with the 10-inch Brashear doublet, the second set with the 6-inch, and the third set (consisting of one plate) with the 3·4-inch doublet, all of the Bruce telescope of the Yerkes Observatory.

List of Lantern Slides of the Comet.

1st set, made with the 10-inch.

No.	Mid. Exposure C.S.T.		Duration of Exposure.
	1908.	h m	h m
1	Sept. 30	14 22	1 56
2	Oct. 1	13 43	2 0
3	2	14 59	2 49
4	3	11 7	2 28
5	6	15 58	1 24
6	15	6 57	1 22

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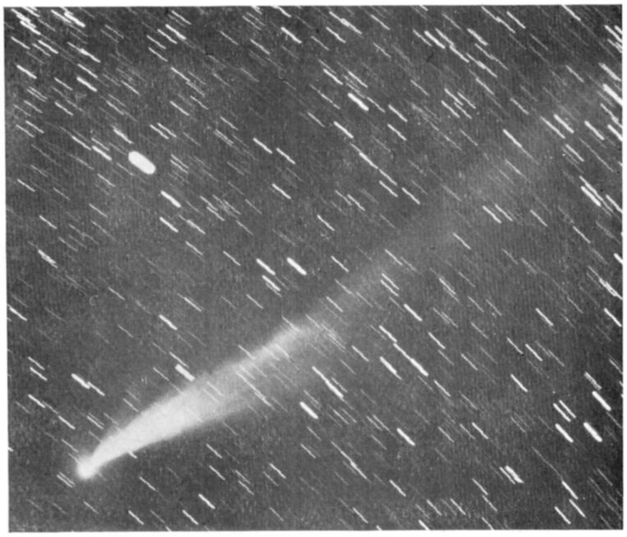
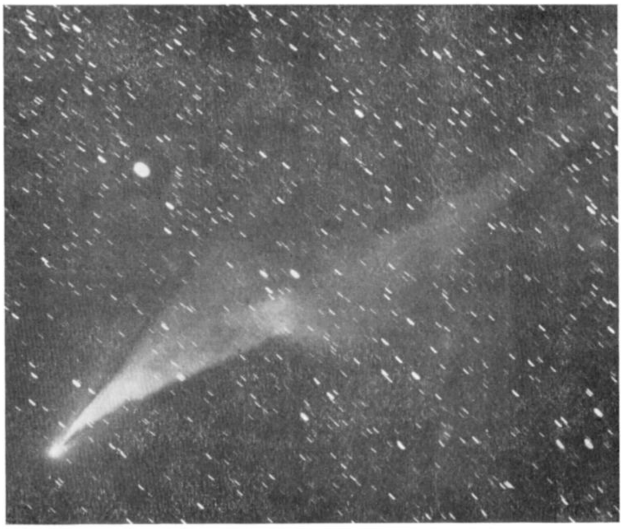
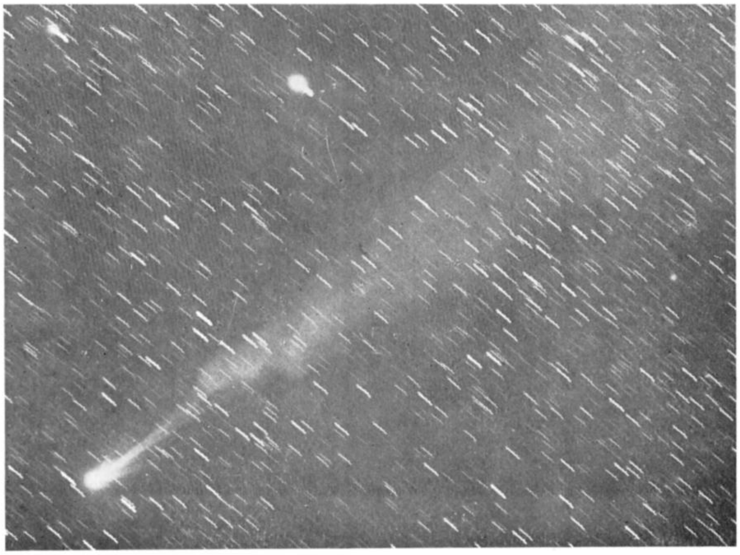


1908 Sept. 30 d. 11 h. 16 m. C.S.T. (6-inch.)



1908 Sept. 30 d. 14 h. 57 m. C.S.T. (6-inch.)



1908 Oct. 6 d. 15 h. 58 m. C.S.T. (10-inch.)

COMET c 1908 MOREHOUSE.—E. E. BARNARD.

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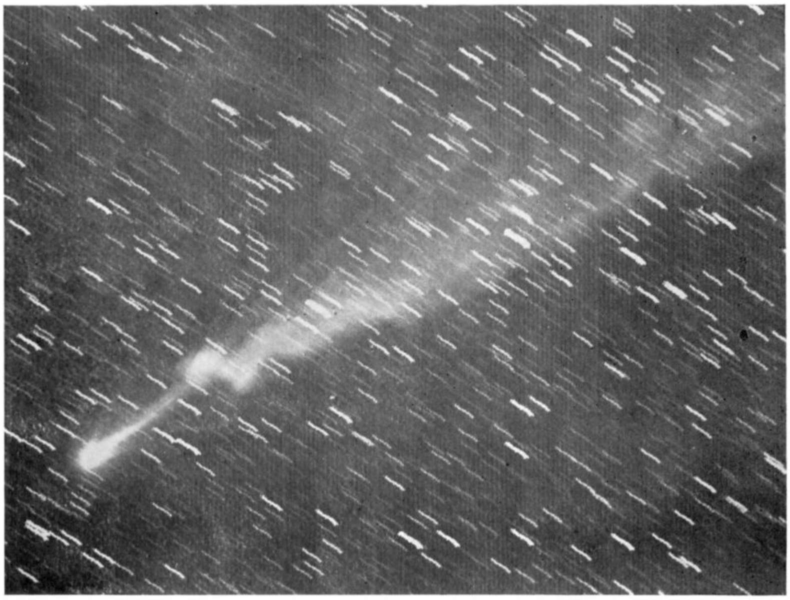
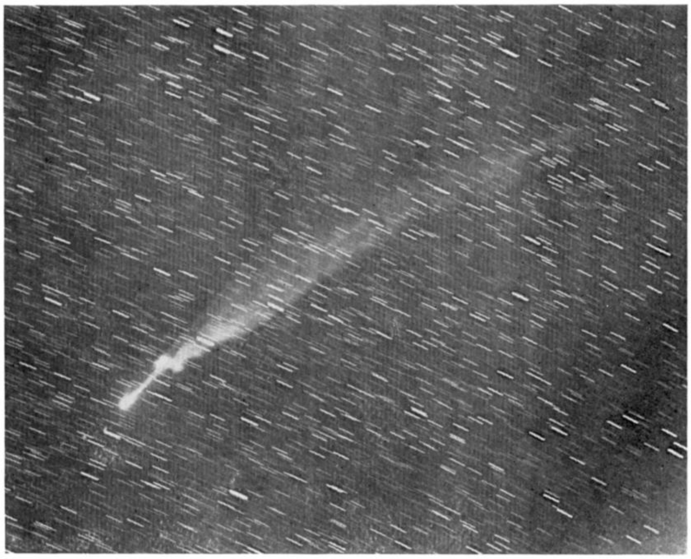


1908 Oct. 15 d. 6 h. 57 m. C.S.T. (10-inch.)



1908 Oct. 15 d. 7 h. 34 m. C.S.T. (3·4-inch.)

COMET c 1908 MOREHOUSE.—E. E. BARNARD.